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WATER AUDIT FOR TRIMBAKESHWAR COUNCIL

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ABSTRACT

A water audit determines the amount of water lost from a water supply system and the cost of this loss to the utility. It will quantify Unaccounted for Water (UFW) and Non-Revenue Water (NRW). Water audits balance the amount produced with the amount billed and account for the remaining water (loss). Comprehensive audits can give the utility a detailed profile of the water supply system and water users, allowing easier management of resources and improved reliability. It is an important step towards water conservation and, if linked with a leak detection plan, can save the utility a significant amount of money and time.

Keywords: Non-Revenue Water (NRW),Unaccounted for Water (UFW)

I. INTRODUCTION

1.1 About Trimbak City:

Trimbak town is 28 km from Nashik city and situated in Hillock surroundings. Trimbak is a "C" class Municipal Council in Indian state of Maharashtra. The town is famous for Lord Trimbakeshwar Temple and as the source of Godavari River. The town is appealing with natural attractions. It is dedicated to Lord Shiva and is one of the twelve Jyotirlingas. The extraordinary feature of the Jyotirlinga located here is the Linga in the temple is in the form of a three faced embodying Tridev; Lord Brahma, Lord Vishnu and Lord Shiva. All other Jyotirlingas have Shiva as the main deity .The Linga is crowned with a jewel studded crown believed to be from Pandavas. The crown is adorned with diamonds, emeralds, and many other types of precious stones. Trimbakeshwar town is an ancient Hindu Pilgrim center located at the source of the Godavari River, the longest river in peninsular India. The Godavari River, which is considered sacred within Hinduism, originates from Bramhagiri Mountains at Trimbakeshwar and meets the sea near Rajahmudry. It is at the foothills of amazing Brahmagiri & Gangadwar mountains nestled among lusting green woody trees and picturesque environments. The serene ambiance and the pleasant climate make the town of Trimbakeshwar a hot spot for nature loving tourists apart from Hindu pilgrims. After every 12 years there is a huge Kumbhamela. In the year 2015 there is Kumbhamela. In Trimbak town near about 30,000 Pilgrims and 25000 Sadhu & Sant visit this place daily. In Sinhastha Parvani period near about 60000 Pilgrims & 160000 Sadhu & Sant expected to be visiting the place. Some of the groups of Sadhus have their own permanent residing places at Trimbak known as "Akhada". There is no railway station near to Trimbak Taluka in less than 10 km. Nasik Road Railway Station (near to Nashik), Igatpuri Railway Station (near to Igatpuri), Block & Catch Siding Cabin 2 Railway Station (near to Igatpuri) are the Railway

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stations reachable from nearby towns. Igatpuri, Nashik, Trimbak are the nearby by towns to Trimbak having road connectivity to Trimbak.

1.2 Historical Background:

There was a city built which later on became famous as Trimbakeshwar. In the period of the Peshwas regime Nana Saheb Peshwa had instructed to construct the Trimbakeshwar temple and developed and beautified the city of Trimbakeshwar. Neel Mani - Once a large Neel Mani (Blue Diamond) now named as Nassak Diamond, adorned the Trimbakeshwar temple. The Diamond was looted by English colonel named J. Briggs from Bajirao Peshva. In turn, Briggs delivered the diamond to Francis Rawdon-Hastings which then went to England

1.3 Religious Background:

The Hindu belief is that those who visit Trimbakeshwar attain salvation or Moksha. Trimbakeshwar is considered as the most sacred town India. There are many reasons for this belief. Godavari originates from the Brahmagiri hills in this town and it is believed that it is the birth place of Lord Ganesha, known as place of Tri-Sandhya Gayatri. This place is believed to be the holiest and ideal place to do Shraddha ceremony, a Hindu ritual for the salvation of the soul. Sinhastha Mahatmya speaks of Lord Rama having made the Yatra at Trimbakeshwar. A shraddha on the river Godavari gives great satisfaction to the forefathers. If it is not done in this place, it is considered as a religious sin. So Ganga Pujan, Ganga Bhet, Deh Shuddhi Prayaschitta, Tarpan Shraddha, Vayan, Dasha Dana, Gopradan etc. rituals are done in Trimbakeshwar. Mundana and Tirtha Shraddha are also performed here. The Lord Shiva at Trimbakeshwar is worshipped by recitations of Rudra, Rudri, Laghu Rudra, Maha Rudra or Ati Rudra puja. Actually Rudraksha is a religious fruit which is said to be found in Lord Shiva's neck in the form of Rudra garland. Some of the trees of Rudraksha are also found in Trimbakeshwar. The holy Jyotirlinga circuit will be complete with the visit to this sacred Shiva temple.The public and religious institutions in the town are Veda shala, Sanskrit Pathashala, Kirtan Sanstha, Pravachan Sanstha, two gymnasiums, Lokmanya Free Reading Room, Municipal Office, Post and Telegraph Office, Bus station, dispensary and a Police sub-inspector's office. Sanskrit Pathashala has produced a good many disciples who have become Shastris and Pandits. Noted film maker and father of Indian cinema, Dadasaheb Phalke was born here. There are two pradakshinas (ring routes) in this kshetra - one round the Brahmagiri and the other one round Hariharagiri. Pilgrim has to go for pradakshina with holy garment early in the morning visiting and bathing in various tirthas. The tour is to be completed in either a day, three days.

1.4 Geography:

Trimbak is located at 19.56°N 73.32°E. It has an average elevation of 720 meters (2362 feet). Trimbak is located at foothills of "Nil Parvat". It is surrounded by Bramhagiri Hills.

II. IMPORTANCE OF WATER AUDIT:

- A water audit determines where the water ends up and how much of it got there.
- All water systems lose some amount of water for a variety of reasons
- There are no accurate statistics for how much water is lost.
- Some water loss is unavoidable, and it is not worth the expense to try to eliminate every drop escaping your system.

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- However, most of the loss that occurs in water systems can be better managed by using a water audit

III.PRESENT WATER SUPPLY MANAGEMENT:

Trimbak Municipal Council lifting the water supply to city from three sources. First is from Amboli MI tank which is around 10 Km from city. Second is from GautamiGodawari Dam which is around 8.5 Km from city and third is from Ahilya Well which is nearer to city. At present there are three WTP's. Neel Parvat old WTP of capacity 2.40 MLD, Neel Parvat new WTP of capacity 2.60 MLD &Gadhai WTP of capacity 1 MLD.

List of Existing service reservoirs used for distribution:

- RCC sump cum MBR of 4.40 LL capacity (Neel Parvat new WTP Premises).
- RCC GSR of 32.20 LL capacity (Neel Parvat old WTP Premises).
- Gadhai WTP Sump (Gadhai WTP Premises).
- RCC new ESR of 4.0 LL capacity (Gadhai WTP Premises).
- RCC HP Godown ESR of 2.20 LL capacity.

These service reservoirs are supplying water to the city. Since, the city is expanding rapidly, the water supply system of the city is designed for 135 LPCD.

Audit is necessary to judge the performance of system for following key parameters:

Revenue details of last three year & actual parameter based on DMA study is presented below.

Thus, the losses of water as well as revenue play a major role in obstructing the civic body's self-sustaining system growth and quality life to citizens. Since a single drop of water is very precious in the present environmental scenario, it is necessary to evaluate the present system and implement the control plan for future.

Statistically, the following key parameters indicate deficiency & potential to carry out audit of system to upgrade the system.

S. No.	Factor Affecting Revenue Loss	Study Parameters To Derive The Differences			Remarks
1	Revenue Gains / Losses out of Expenses and Returns	O & M Expenditure + Water Reservation Charges	Vs.	Revenue Collection	Affects self-sustainability of the System
2	Short of Efficiency in recovery	Taxation Demand Actual Raised	Vs.	Actual Recovery Done	Affects future investment plans
3	Loss due to Non-registered Connections	Taxation Demand Applicable	Vs.	Taxation Demand Actual Raised	Need to assess the actual consumers
4	Water Transmission Losses	Standard Billable Amount of Water	Vs.	Actual Billed Amount of Water	Physical Losses of Water

IV. SELF-SUSTAINABILITY OF PROJECT:

For self-sustainability of scheme deficit should be Zero. Statement of Expenditure & Revenue collection of Water supply section for last three financial years is as follows.

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Particulars	2012-13	2013-14	2014-15
Demand (Lac)	39.86	52.45	43.01
Recovery (Lac)	17.81	33.29	28.50
Deficit (Lac) [A - B]	22.05	19.16	14.51
Collection efficiency (%) =(B/A*100)	**44.68**	**63.47**	**66.26**

V. LAYOUT OF TRIMBAK WATER SUPPLY SYSTEM:

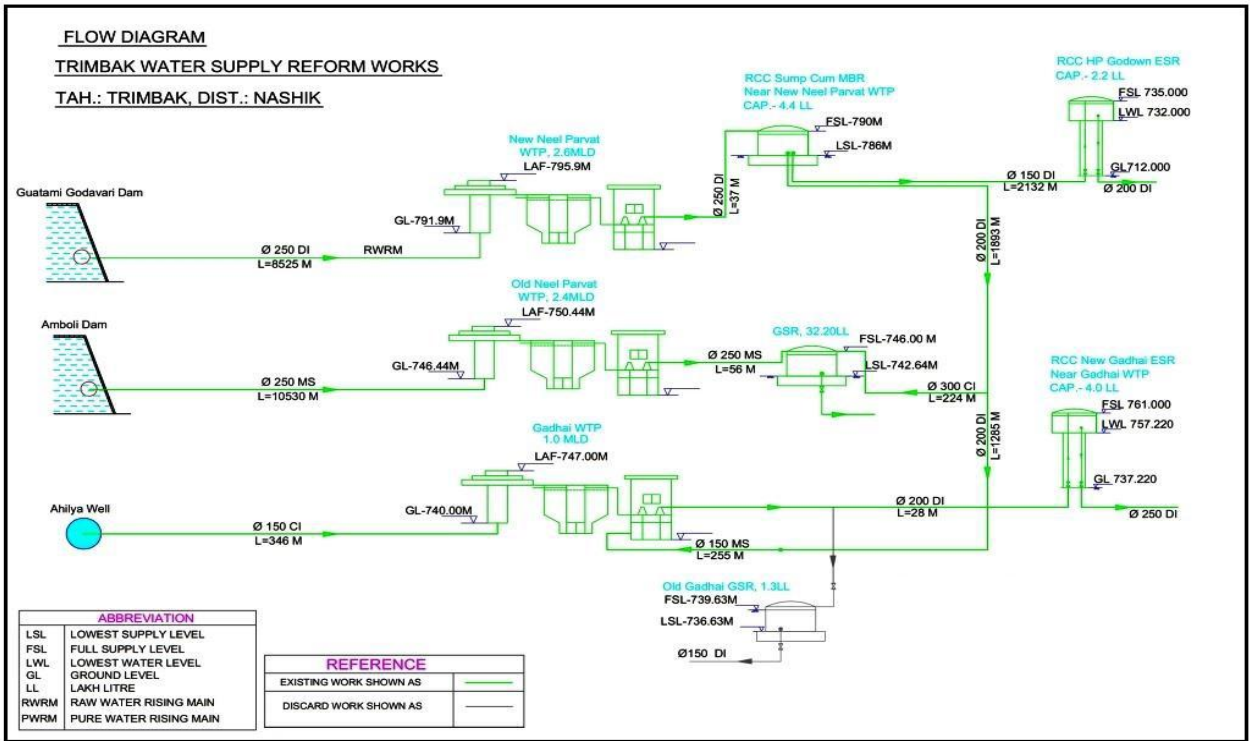

Fig: Layout of Trimbak Water Supply System

The scheme consisted following head works:

A. Intake Well: Intake well 2 m diameter and 4.50 m deep in the basin of Amboli MI tank in UCR masonry with 3 No's rose pieces.

B. Connecting Main: 300 mm diameter CI "LA" class of 22 m length from intake well to Jack well.

C. Jackwell well with overhead pump house: Jackwell well 6 m diameter and11.50 m deep in UCR was constructed overhead pump house 6 m diameter and 4.5m height in BB masonry over Jackwell was constructed.

D. Approach Bridge: Approach Bridge from top of MI tank to Jackwell of 42 m length and 1.20 m width with GI pipe railing was constructed.

E. Pumping Machinery: Duplicate set of 50 BHP VT pumps with discharging capacity 100000 LPH against total 63 m head with 100 % standby arrangements are done.

F. Rising Main: Rising main of capacity 2.4 MLD of 250mm diameter AC class IV pipes for length 10230 m head work to WTP is provided.

G. Treatment Plant: Simplified WTP of cap 2.40 MLD is constructed on hillock of "Neel Parvat"

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H. RCC GSR: RCC GSR of capacity 600000 liters with 15 m diameter and 3.50 m water depth is constructed near WTP.

I. Distribution System: 300 mm & 80 mm diameter CI pipes are laid 1125 RMT for town. Remaining parts of town and Akhadas are covered by lying CI & GI pipe distribution system under separate funds for Sinhastha 1991.

Rate of water supply:

Town Population	135 LPCD
Floating Population	15 LPCD
Sadhu Sant	20 LPCD

Total Number of Connections:

1	Total no of Properties	3864
2	Total no of council connections	1958
3	Total no of new connections	125
4	Total no of Domestic Connections	1573
5	Total no of commercial connections	140
6	Total no of Institutional connections	31
7	Total no of other connections	1
8	Total no of properties not having connections	1955

Calculated Bucket Readings During Project:

Sr.No	Date			Consumer Name	Supply Hrs (Sec)		45 Mins (2700 Sec)
	Month	Date	Year		Bucket Size	Filling Time	
1	Dec	1	2016	Vikas Gulve	10	24	1125
2	Dec	2	2016	Vikas Gulve	10	28	964
3	Dec	3	2016	Vikas Gulve	10	20	1350
4	Dec	4	2016	Vikas Gulve	10	29	930
5	Dec	5	2016	Vikas Gulve	10	30	900
6	Dec	6	2016	Vikas Gulve	10	20	1350
7	Dec	7	2016	Vikas Gulve	10	25	1080
8	Dec	8	2016	Vikas Gulve	10	19	1421
9	Dec	9	2016	Vikas Gulve	10	28	964
10	Dec	10	2016	Vikas Gulve	10	22	1227
11	Dec	11	2016	Ravindra Kadu	10	26	1038
12	Dec	12	2016	Ravindra Kadu	10	28	964
13	Dec	13	2016	Ravindra Kadu	10	18	1500
14	Dec	14	2016	Ravindra Kadu	10	25	1080
15	Dec	15	2016	Ravindra Kadu	10	29	931
16	Dec	16	2016	Ravindra Kadu	10	24	1125
17	Dec	17	2016	Ravindra Kadu	10	19	1421
18	Dec	18	2016	Ravindra Kadu	10	24	1125
19	Dec	19	2016	Ravindra Kadu	10	28	964
20	Dec	20	2016	Ravindra Kadu	10	21	1285
21	Jan	5	2017	Chetan Jain	10	18	1500
22	Jan	6	2017	Chetan Jain	10	22	1227

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23	Jan	7	2017	Chetan Jain	10	29	9931
24	Jan	8	2017	Chetan Jain	10	25	10800
25	Jan	9	2017	Chetan Jain	10	22	12227
26	Jan	10	2017	Chetan Jain	10	29	9931
27	Jan	11	2017	Chetan Jain	10	18	15000
28	Jan	12	2017	Chetan Jain	10	22	12227
29	Jan	13	2017	Chetan Jain	10	26	10380
30	Jan	14	2017	Chetan Jain	10	21	12860
						total	372370

Calculation of losses:

There are **255** connections in Gadhai WTP.

Above 3 connections get avg 3798 liters in 45 minutes. There are 255 connections, they get 3798*255=322830 in

45 Minutes. Total capacity of gadhai ESR is 4 Lac Liters. We get 322830 liters of water out of 400000 liters. Remaining 77170 liters of water is getting wasted through various losses. Which is about 24% of total water. The total losses is about 24%. These losses are only from ESR to Consumer End. The other losses are not included like Transmission losses, WTP losses, etc. According to CPHEEO Manual the adorable losses are 15% (It includes Transmission Losses upto 8-9% and WTP to ESR is 4-5% and other losses are upto 5%).

The total losses in Gadhai ESR is 24%+15%=39%.

This is very serious condition. In this project we will give council better solution to tackle these losses and help to them improve their profit. We give them suggestion at free of cost.

The bucket readings from HP GODOWN ESR:

Sr no	Date			Consumers Name	Supply hrs (Sec)		45 Mins
	Month	Date	Year		Bucket Size	Filling Time	
1	Dec	1	2016	Mauli Hotel	10	19	1421
2	Dec	2	2016	Mauli Hotel	10	15	1800
3	Dec	3	2016	Mauli Hotel	10	22	12227
4	Dec	4	2016	Mauli Hotel	10	30	9000
5	Dec	5	2016	Mauli Hotel	10	18	15000
6	Dec	6	2016	Mauli Hotel	10	25	10800
7	Dec	7	2016	Mauli Hotel	10	35	7771
8	Dec	8	2016	Mauli Hotel	10	21	12855
9	Dec	9	2016	Mauli Hotel	10	26	10380
10	Dec	10	2016	Mauli Hotel	10	31	8700
11	Dec	11	2016	Amrut Lodge	10	48	5622
12	Dec	12	2016	Amrut Lodge	10	36	7500
13	Dec	13	2016	Amrut Lodge	10	45	6000

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14	Dec	14	2016	Amrut Lodge	1	0	3	9	6	9	2
15	Dec	15	2016	Amrut Lodge	1	0	3	5	7	7	1
16	Dec	16	2016	Amrut Lodge	1	0	4	2	6	4	2
17	Dec	17	2016	Amrut Lodge	1	0	2	8	9	6	4
18	Dec	18	2016	Amrut Lodge	1	0	3	8	7	1	0
19	Dec	19	2016	Amrut Lodge	1	0	4	5	6	0	0
20	Dec	20	2016	Amrut Lodge	1	0	2	4	1	1 2	5
21	Jan	5	2017	Jai Malhar Dhaba	1	0	5	0	5	4	0
22	Jan	6	2017	Jai Malhar Dhaba	1	0	5	6	4	8	2
23	Jan	7	2017	Jai Malhar Dhaba	1	0	4	5	6	0	0
24	Jan	8	2017	Jai Malhar Dhaba	1	0	5	5	4	9	0
25	Jan	9	2017	Jai Malhar Dhaba	1	0	5	0	5	4	0
26	Jan	10	2017	Jai Malhar Dhaba	1	0	4	6	5	8	6
27	Jan	11	2017	Jai Malhar Dhaba	1	0	4	9	5	5	1
28	Jan	12	2017	Jai Malhar Dhaba	1	0	5	4	5	0	0
29	Jan	13	2017	Jai Malhar Dhaba	1	0	4	8	5	6	2
30	Jan	14	2017	Jai Malhar Dhaba	1	0	5	0	5	4	0

Problem Statement:

Water is the driving force of all nature. Entire world is struggling for its conservation. For us, wastage of water is a critical issue as India is one amongst the top 12 water poor countries. However, looking into the practical hurdles of fetching water from source to the households, loss of 20% is permitted by CPHEEO (Central Public Health and Environmental Engineering Organization), a department of Ministry of Urban Development, who is responsible for setting the qualitative and quantitative standards of water utility in India.

Revenue collected by the citizens has a major share in running the Water Supply Scheme for any Urban Local Body and hence the ULBs shoulder a great responsibility to cater an efficient and sufficient Water Supply Services to them. This enforces the necessity of Water Audit as it is meant for quantitative study of the entire system.

Objectives of Project:

- To measure the system inputs.
- To identify and measure the system input & output points.
- Measurement of authorized / unauthorized consumption.
- Measurement of water losses.
- Suggestions for loss reduction, leak detection & corrective measures.
- Analyze water audit results for NRW reduction.
- To determine DMA (District Metering Area).
- To identify potential to reduce NRW.

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Advantages of Water Audit:

- Water audits provide decision making tools to utility managers, directors, and operators. i.e., knowing where water is being used in your system allows you to make informed decisions about investing resources such as time, labor and money.
- Water audits allow managers to efficiently reduce water losses in the system.
- Reducing water used at the source may even result in delaying or avoiding capital investments such as a new well, more treatment technology or additional water rights.
- Water audits also identify which water uses are earning revenue for the utility and which water uses are not. Thus, System personnel can increase revenue by ensuring all appropriate uses are being accurately measured and billed. This leads to more financial capacity in the water system, reduced cost per customer and better management of the water resource.
- Creating awareness among water users i.e., customers can see and understand that the utility is taking proactive steps to manage wasted water and save for the future.
- It is an effective educational and public relations tool for the water system.

Methodology of water Audit:

The standard water balance or methodology is the framework for categorizing and quantifying all wateruses in the water audit. It is called a balance because when it is completed, all uses of water in the system equalthe amount of water input by the sources. All water use is accounted for in the standard water balance (eliminating the need for the term unaccounted-for water). The standard water balance is really a series of simple equations. This is the most common way to view the standard water balance and developed by American Water Works Association (AWWA) and International Water Association (IWA) in 2000. It may also be presented in the form of separate equations, or in worksheet format. Begin by reading the graphical standard water balance from the left side, starting with the System Input category. It is important to understand that the vertical height of each category represents a proportional amount of water. Thus, the height of the System Input category represents all water pumped by the system in a given time period. This amount of water can be broken down into two additional categories, authorized Use and Water Losses. Therefore, Authorized Use + Water Losses = System Input. This vertical height water measurement holds true across the entire standard water balance.

Following identify important relationships just by glancing at the standard water balance:-

Water Losses = Apparent Losses + Real Losses.

Nonrevenue Water = Water Losses + Unbilled Authorized Use.

Apparent Losses = Metering Inaccuracies + Unauthorized Use.

VI. CONCLUSION

- With the help of Water Audit we can able to find the leakage and calculate the losses in the system and take the necessary measure for the future and fix the performance target for improve the service level benchmark of the area.
- Ultimately the availability of water in not the actual problem. But efficient management of water is the major issue that we need to work on.
- Water audit help to quantify all forms of losses and helps in reducing the non-revenue water.

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- Water audit study shall be covered the holistic approach towards total water resource, distribution and its efficient use to reduce the capital and operating cost as an added advantage over the optimized use of water resource with environment protection..

PHOTO GALLERY:

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